Template for ISB Documentation of Stressors

A. General Information:

1. Name or Location of Example/Approach: European rivers

2. Literature/Citations Used: Tochner, K., M. Pusch, D. Borchardt, M.S. Lorang. 2010. Multiple stressors in coupled river–floodplain ecosystems. Freshwater Biology 55 (Supple. 1):131-151.

3. Reviewer(s): V. Resh

B. Specific Questions:

1.What stressors are considered? Flow reductions and modifications

2. Are stressors categorized? If so, how? As above

3. Are the relations between stressors and management objectives modeled, and if so, how? 4. If stressors are prioritized, describe the general approach. A key challenge is to disentangle human stressors from natural drivers and to trace the sources and pathways of individual stressors through the catchment. The "fingerprint" technique offers an opportunity to quantitatively estimate the relative contribution of distinct emission sources to the contamination of river water and floodplain soils (see references below). So far, the fingerprint approach has mainly been applied to detect chemical and faecal contaminations, but it might be very useful to identify and separate physical, chemical and biological pressures. **However, authors don't say how....**

5. How might this approach be relevant to Bay Delta? They emphasize the effects of hierarchically arranged environmental filters on the biological inventory and ecosystem functions of a river–floodplain system and the same situation exposed to multiple anthropogenic stressors. Under both conditions, the varying prevalence and seasonal dynamics of environmental factors produced by regional climate, geology, geography, riverine hydrology and water chemistry determine the composition of the biotic community in a specific river reach and adjacent floodplain, as well as important ecological pathways and functions. Under undisturbed conditions, these environmental factors act as a filter for the colonisation of the respective catchment by biota, as their traits (e.g. habitat preferences or seasonal timing of life history steps) need to be supported by the resources offered in the catchment. Like that, catchment settings may even govern the pathways and efficiency of ecosystems functions. Anthropogenic multiple stressors add an additional filter that may interact with the biological traits of organisms. Hence, fingerprints of human pressures may be reflected in the species traits present in the biotic community, which do not only respond to abiotic settings, as well as in ecosystem functions.

6. Follow up regarding additional questions/literature review/etc?

Collins A.L., Walling D.E. & Leeks G.J.L. (1997) Fingerprinting the origin of fluvial suspended sediment in larger river basins: combining assessment of spatial provenance and source type. Geografiska Annaler Series A, 79, 239–254.

Walling D.E., Owens P.N. & Leeks G.J.L. (1999) Fingerprinting suspended sediment sources in the catchment of the River Ouse, Yorkshire, UK. Hydrological Processes, 13, 955–975.

Carter J., Owens P.N., Walling D.E. & Leeks G.J. (2003) Fingerprinting suspended sediment sources in a large urban river system. The Science of the Total Environment, 314–316, 513–534.

Very few studies have attempted to quantify the sources of suspended sediment transported in urban river systems. In this study, statistically verified composite fingerprints and a multivariate mixing model have been used to identify the main sources of the suspended sediment transported by the River Aire and its main tributary, the River Calder. Because of the polluted nature of the Aire/Calder catchment and its effect on fingerprint property concentrations, source tracing was undertaken separately for the upper and lower reaches. The mean contributions from individual source types (i.e. surface materials from woodland, uncultivated and cultivated areas, channel bank material, road dust and solids from sewage treatment works) varied between the upper and lower reaches of the rivers, reflecting the change in land use from primarily pasture and moorland in the upper reaches to mainly urban areas (with some cultivated land) in the lower reaches. The suspended sediment in the upper reaches of the River Aire originates largely from channel bank sources (43-84%) and from uncultivated topsoil (16-57%). In the lower reaches of the Aire/Calder system, local sources of cultivated topsoil contribute 20-45% of the suspended sediment load and there is a significant contribution from urban sources, such as road dust (19-22%) and solids from sewage treatment works (14-18%). In the upper reaches, the proportion of sediment derived from each of the two main geological areas corresponds broadly to the proportion of the catchment occupied by each geological area. The relative contribution from the Rivers Aire and Calder to the suspended sediment load transported below the confluence demonstrates that most of the sediment is derived from the River Calder.